ELECTRIC LAMP/REFLECTOR UNIT

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US5506464
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WO9853475

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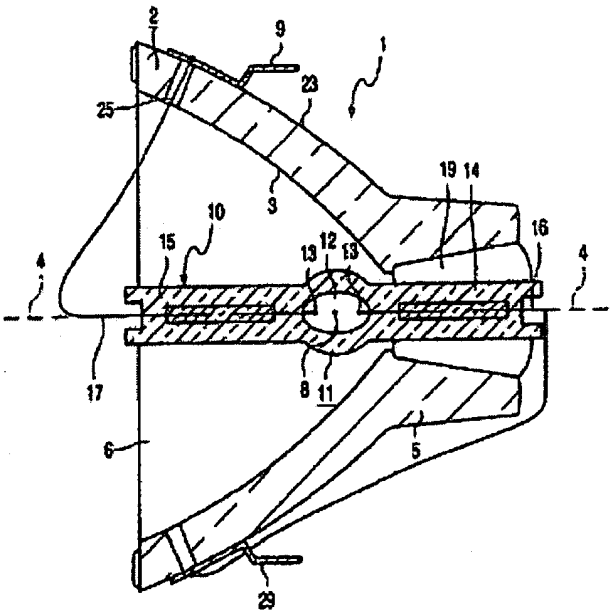
Abstract of **WO0161730**

The electric lamp/reflector unit has a molded reflector body (1) comprising a hollow neck-shaped portion (5). An electric lamp (10) having a lamp vessel (11), having a space (12) in which an electric element (13) is arranged, and provided with a first (14) and a second, opposed end portion (15) is fixed with its first end portion (14) within the neck-shaped portion (5). The molded reflector body (1) is made of a temperature shock resistant glass-ceramic material and offers the advantages that the reflector body (1) is better resistant to a possible explosion of the lamp (10) and that an improved positioning of the electric element (13) in the reflector body (1) is obtained.



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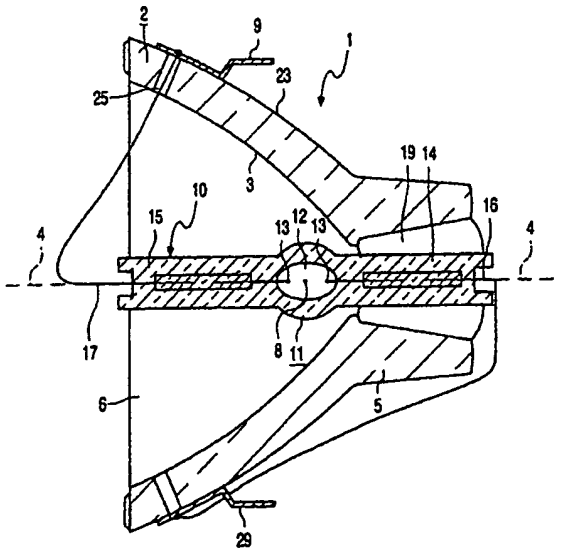


(57) Abstract: The electric lamp/reflector unit has a molded reflector body (1) comprising a hollow neck-shaped portion (5). An electric lamp (10) having a lamp vessel (11), having a space (12) in which an electric element (13) is arranged, and provided with a first (14) and a second, opposed end portion (15) is fixed with its first end portion (14) within the neck-shaped portion (5). The molded reflector body (1) is made of a temperature shock resistant glass-ceramic material and offers the advantages that the reflector body (1) is better resistant to a possible explosion of the lamp (10) and that an improved positioning of the electric element (13) in the reflector body (1) is obtained.

WO 01/61730 A1

Electric lamp/reflector unit

The invention relates to an electric lamp/reflector unit comprising:

a molded reflector body provided with a reflector portion with a focus, with an optical axis, and with a concave reflecting inner surface between a neck-shaped portion and a light emission window which is transverse to the optical axis;

an electric lamp provided with a light-transmitting lamp vessel which is closed in a vacuumtight manner and which has a cavity in which an electric element is arranged, and which has a first and a second end portion which are mutually opposed and have respective seals through which a respective first and second current conductor connected to the electric element issue from the lamp vessel to the exterior,

the electric lamp being fixed in the reflector body with its first end portion in the neck-shaped portion, the cavity within the reflecting portion, and the electric element in the focus and on the optical axis.

Such an electric lamp/reflector unit is known from EP 595412. Units of this kind may be used for projection purposes, for example film or slide projection, but they may also be used in projection TV equipment. Users of such projection equipment continuously strive for an improved safety and miniaturization of the equipment. There is also a wish for this miniaturization to take place without an accompanying loss of screen lumens. Such a loss of screen lumens may occur, for example, owing to a decrease in the size of the reflecting surface. Such a loss of screen lumens may also result from a comparatively inaccurate positioning of the electric element in the reflector body, whereby the light generated by the lamp is less well aimed and concentrated into a beam by the reflector body. It is a disadvantage of the known lamp/reflector unit that the positioning of the electric element is comparatively inaccurate. A further disadvantage of the known lamp/reflector unit is that a possible explosion of the lamp involves the risk of the reflector body cracking and/or fracturing owing to this explosion.

It is an object of the invention to provide an electric lamp/reflector unit of the kind described in the opening paragraph which can be manufactured comparatively

inexpensively and easily, in which a comparatively accurate positioning of the electric element in the reflector body is obtained, and which is comparatively well resistant to a possible explosion of the lamp.

According to the invention, this object is achieved in that the electric lamp/reflector unit of the kind described in the opening paragraph is characterized in that the reflector body is manufactured from a glass-ceramic material with a coefficient of thermal expansion of between $-2\times10^{-6}K^{-1}$ and $3\times10^{-6}K^{-1}$. Such a coefficient of thermal expansion represents an average coefficient of thermal expansion over a temperature range of 0 to 500 °C. The reflector body has a better thermal shock resistance when the reflector body manufactured from a glass-ceramic material with such a coefficient of expansion is used.

The glass-ceramic material is obtained by a comparatively simple and inexpensive process comprising a partial crystallization of a glass suitable for this purpose. Known multi-phase systems from which such glass-ceramic materials are known are, for example, Li_2O-SiO_2-Al_2O_3, Li_2O-SiO_2-Al_2O_3-P_2O_5, Na_2O-ZrO_2-SiO_2-P_2O_5, and Li_2O-SiO_2-Al_2O_3-MO, with M being, for example, Mg, Zn, Ca, and/or Ba. Known glass-ceramic materials are, for example, $LiAlSiO_4$-$LiAlSi_2O_6$, and $Mg_2Al_4Si_5O_{18}$. To obtain a reflector body made from glass-ceramic material, a reflector body of glass is first manufactured. Then the reflector body is brought to a temperature at which a crystallization of the glass commences. The reflector body is subsequently kept at this temperature for some time, for example a few hours, until a glass-ceramic material with a sufficient degree of crystallization has been obtained, whereupon it is cooled down. The reflector body of glass-ceramic material is thus obtained in a comparatively simple and inexpensive manner, and has a bulk composition of a mixture of a crystalline phase and a glass phase.

The quantity of screen lumens obtained from the lamp/reflector unit is strongly dependent on the positioning of the electric element of the lamp with respect to the focus of the reflector body. During assembly of the lamp/reflector unit, the lamp is placed in an aligned position in the reflector body, such that the electric element is positioned in the focus. Usually this positioning takes place while the lamp/reflector unit is not being operated, i.e. the lamp/reflector unit is comparatively cold. When switched on, the lamp/reflector unit will heat up, and respective components of the lamp/reflector unit, such as the reflector body and the lamp, will expand, thus causing changes in the relative positions of the components. The change in position of the electric element relative to the focus depends on the difference in coefficient of thermal expansion between the lamp and the reflector body. If there is a comparatively great difference in expansion, because the lamp/reflector unit becomes

comparatively hot while the coefficients of thermal expansion differ comparatively much from one another, for example at differences of more than $2.5\times10^{-6}K^{-1}$ over a temperature range of at least 400 °C, there will be a too great change in the position of the electric element with respect to the focus of the reflector body. The lamp is manufactured from quartz glass, i.e. glass having an SiO_2 content of at least 95% by weight, which has a coefficient of thermal expansion of approximately $0.6\times10^{-6}K^{-1}$. Since the reflector body is manufactured from a glass-ceramic material with a coefficient of expansion which corresponds roughly to the coefficient of thermal expansion of quartz glass, i.e. between $-2\times10^{-6}K^{-1}$ and $3\times10^{-6}K^{-1}$, an acceptably small change in the mutual positioning of the electric element and the focus will occur. A comparatively large quantity of screen lumens is thus obtained from the lamp/reflector unit according to the invention.

Said change is also dependent on the temperature difference between the lamp and the reflector body arising during operation of the lamp/reflector unit. The lamp then becomes comparatively hot as compared with the reflector body. It is favorable when the coefficient of expansion of the reflector body is somewhat greater than that of the lamp so as to obtain an expansion of both components such that the electric element at least substantially does not become shifted with respect to the focus. Preferably, the glass-ceramic material has a coefficient of expansion of between $1\times10^{-6}K^{-1}$ and $2\times10^{-6}K^{-1}$. Such a coefficient of thermal expansion represents an average coefficient of thermal expansion over a temperature range of 0 to 500 °C. Given such values for the coefficient of expansion of the glass-ceramic material, the electric element will remain at least substantially positioned in the focus. A larger quantity of screen lumens can thus be obtained from the lamp/reflector unit according to the invention.

Experiments have also shown that the reflector body has an improved temperature resistance and is better resistant to a possible explosion of the lamp. Since the coefficients of thermal expansion of the glass-ceramic material of the reflector body and the quartz glass of the lamp differ comparatively little from one another, the temporary mechanical stresses arising during operation of the lamp/reflector unit are comparatively small. On the other hand, this renders possible the use of the reflector body at a comparatively high temperature, for example of up to approximately 700 °C instead of 450 °C as with the use of a glass reflector body, while the safety of the lamp/reflector unit is retained.

A reflector for a lighting unit is known from DE-3002085 A1, wherein the reflector is manufactured from a ceramic material having a low coefficient of expansion. The

manufacture of such a reflector, however, is labor-intensive and comparatively expensive. A further disadvantage is that an accurate shape of the reflector is difficult to realize.

WO 98/53475 describes a reflector manufactured from a quartz-ceramic material. A disadvantage of such a reflector is that the reflector is to be manufactured in a labor-intensive and comparatively expensive process which has a high reject percentage.

The electric element may be an incandescent body, for example in an inert gas comprising halogen, or a pair of electrodes in an ionizable gas.

An embodiment of the electric lamp/reflector unit according to the invention is shown diagrammatically in axial sectional view in the Figure.

In the Figure, the electric lamp/reflector unit has a molded reflector body 1 which is provided with a reflector portion 2 having an optical axis 4 and with a hollow neck-shaped portion 5 surrounding the optical axis 4. The reflector portion 2 further comprises a concave, for example paraboloidally curved, reflecting inner surface 3 between the neck-shaped portion 5 and a light emission window 6 which is transverse to the optical axis 4. The reflector body has a focus 8 situated within the reflector portion 2 and on the optical axis 4. In an alternative embodiment, however, said inner surface 3 may be, for example, ellipsoidal in shape. In the drawing, the reflector body 1 is made of a glass-ceramic material, for example of $LiAlSiO_4$-$LiAlSi_2O_6$, and has a mirroring layer formed by a metal layer, for example an aluminum layer. The lamp/reflector unit also comprises an electric lamp 10 which is provided with a light-transmitting lamp vessel 11 which is closed in a gastight manner and which is made, for example, of quartz glass or alternatively of a ceramic material, for example densely sintered aluminum oxide. The lamp vessel 11 has a cavity 12 in which an electric element 13, a pair of electrodes in the Figure with an electrode interspacing of 0.5-1.5 mm, for example 1 mm, is arranged. The lamp vessel 11 has a first 14 and a second, opposed end portion 15 with respective seals, through which seals a respective first 16 and second current conductor 17 connected to the electric element 13 are passed so as to issue from the lamp vessel 11 to the exterior. The lamp 10 shown is a high-pressure mercury gas discharge lamp which has a pressure of 180 bar or more during operation. A filling is furthermore accommodated in the cavity 12 of the lamp vessel 11, comprising mercury and a rare gas, for example argon, and bromine. The electric lamp 10, which has a rated power of between approximately 70 and approximately 150 W, is fixed in the reflector body 1, by means of cement 19 in the Figure, with its first end portion 14 in the neck-shaped

portion 5, the cavity 12 within the reflecting portion 2, and the electric element 13 in the focus 8 and on the optical axis 4.

The current conductor 17 issuing from the second end portion 15 is passed through an opening 25 in the reflector portion 2 to the exterior, where it is connected to a contact member 9 which is provided on an outer surface 23 of the reflector portion 2. The current conductor 16 is passed from the first end portion 14 through the neck-shaped portion 5 to the exterior, where it is connected to a further contact member 29 on the outer surface 23 of the reflector portion 2.

CLAIMS:

1. An electric lamp/reflector unit comprising:

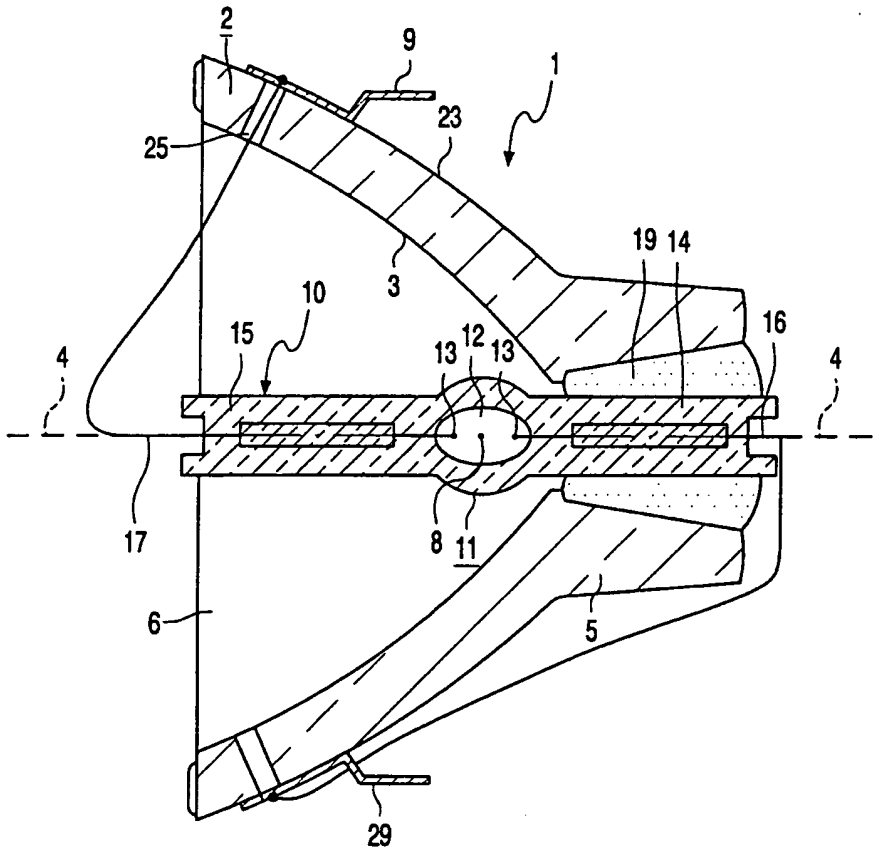
a molded reflector body (1) provided with a reflector portion (2) with a focus (8), with an optical axis (4), and with a concave reflecting inner surface (3) between a neck-shaped portion (5) and a light emission window (6) which is transverse to the optical axis (4);

an electric lamp (10) provided with a light-transmitting lamp vessel (11) which is closed in a vacuumtight manner and which has a cavity (12) in which an electric element (13) is arranged, and which has a first (14) and a second end portion (15) which are mutually opposed and have respective seals through which a respective first (16) and second current conductor (17) connected to the electric element (13) issue from the lamp vessel (11) to the exterior,

the electric lamp (10) being fixed in the reflector body (1) with its first end portion (14) in the neck-shaped portion (5), the cavity (12) within the reflecting portion (2), and the electric element (13) in the focus (8) and on the optical axis (4),

characterized in that the reflector body (1) is manufactured from a glass-ceramic material with a coefficient of thermal expansion of between $-2\times10^{-6}K^{-1}$ and $3\times10^{-6}K^{-1}$.

2. An electric lamp/reflector unit as claimed in claim 1, characterized in that the reflector body (1) is manufactured from a glass-ceramic material having a coefficient of thermal expansion of between $1\times10^{-6}K^{-1}$ and $2\times10^{-6}K^{-1}$.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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 01/00512

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01J61/02 F21V7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01J F21V H01K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 506 464 A (OOMS LEO F M) 9 April 1996 (1996-04-09) cited in the application abstract; figure 1	1
A	DE 30 02 085 A (RITTER AG) 30 July 1981 (1981-07-30) cited in the application claim 1	1
A	WO 98 53475 A (FUSION LIGHTING INC ;LEVIN IZRAIL (US); SHANKS BRUCE (US); SUMNER) 26 November 1998 (1998-11-26) cited in the application abstract	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
8 May 2001	06/08/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Martín Vicente, M

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 01/00512

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